MEASURING THE QUALITY OF HANDWRITING
PART I. OUR PURPOSES IN MAKING A WRITING SCALE

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When Dr. Thorndike advocated the need and the possibility of using a "graphometer" to define qualities in handwriting,[1] he assumed the position of a pioneer in that field. Since the time of that suggestion, however, a number of handwriting scales have been proposed. The general purpose of such a scale and the values which it should give are quite generally understood. It will be well to enumerate them briefly, however, as a starting-point for the study which follows.

1. A scale gives the basis for a common understanding and accuracy in judgment. The mind of a listener or reader is not satisfied to learn merely that someone's handwriting is excellent, good, medium, or poor, so long as those terms refer to an unknown or hidden standard. When we call one specimen of writing good and another poor, we refer to some particular quality of handwriting which is either subjective (in the mind of the speaker) or objective (specified on a scale). Statements based on subjective standards are necessarily mere opinions; but statements based on objective standards are judgments which everyone understands alike. For instance, when a teacher informs her principal that a schoolroom is cold, he asks, "How cold?" If she says 55 degrees, there is at once a common understanding.

a) This enables the writing supervisor to specify unmistakably what the quality of writing should be in a given grade.

b) It enables the teacher to say to the pupils in definite terms how much progress they have made and to compare their status with that of other pupils.

c) It eliminates the conflict of personal opinions which too often results in a feeling of animosity and dissatisfaction.

[1] Teachers College Record, March, 1910.

2. It is a pedagogical aid and stimulus.

a) By its use the pupil compares his present writing with his former writing, even better than he can do it with the "progress" package; and at the same time he can ascertain his standing relative to that of other pupils, either present or absent. The result of either comparison can be expressed in certain terms which all will understand.

b) By using the scale the pupil also learns to analyze his writing and becomes conscious of the particular elements on which he needs to make improvement. Thereafter his practice becomes an intelligent practice.

3. It is valuable to the school administrator and to the scientific student of education in that it enables them to compare different classes or different schools or to test the value of certain methods, without actually bringing the samples before them. When measured and tabulated according to an accepted scale, the study becomes a matter of comparing figures which have a definite and uniform meaning.

Members of the St. Louis Alumni Chapter of Phi Delta Kappa[1] who co-operated in making and in using experimentally the tentative scale presented herewith felt the need of a scale which would measure the writing of their pupils by factors other than mere legibility, the only factor considered in making the Ayres Scale. We are teaching an adopted slant writing. The types of writing on the Thorndike Scale are very unlike the writing most commonly found in our schools. Vertical specimens, for instance, however perfect and legible they might be, would not receive a high rating in our system. To get a scale that will measure the quality of handwriting by all the factors which we seek to develop in our penmanship lessons is our problem. This will include legibility, slant, shape and size of letters, quality of line (movement), spacing, and alignment. To obtain such a scale the following study was undertaken.

[1] H. B. Dickey, Bates School; J. S. Nants, Garfield School; C. R. Stone, Mann School; W. R. Reavis, Laclede School; G. R. Johnson, Marshall School; C. E. Witter, Bryan Hill School; H. H. Ryan, Mullanphy (resigned); H. H. Edmiston, Harrison School; F. W. Wiley, Secretary to the Superintendent, St. Louis.

PART II. HOW THE SCALE WAS MADE

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The group of eight principals met from two to four times a month from November to April inclusive. The head writing supervisor met with the group as an expert adviser. At the beginning a general plan of procedure was adopted. This plan was modified as experience from time to time indicated advisable.

Determining the number of steps on the scale and collecting the papers.—Each of the eight principals had the following dictation written during a writing lesson by all pupils from the fifth to the eighth grade inclusive: "A new pen has a thin covering of oil to keep it from rusting. This oil must be removed before writing so the ink will flow freely. Pupils should use a penwiper or blotter to wipe the oil off the pen. Ink will rust the pen very quickly when left on it. Be sure to remove all ink from the pen when you are through writing."

Each principal ranked his papers into as many groups as he found there were qualities of writing from the poorest to the best. The number of qualities of writing found by the different principals ranged from 12 to 21. This preliminary study was made to help in determining how many steps or qualities there should be in a writing scale for our upper grades. It was finally decided to have fifteen steps or qualities, but that the best sample should be a better sample than any sample produced by the pupils and that the poorest sample should be a poorer sample than any written by a pupil in these grades. The quintile table of distribution is now considered the most serviceable in scientific educational measurement. Fifteen was selected because it is a multiple of five and is approximately the number of qualities of writing that could readily be recognized in these grades. It was then proposed to include the fourth grade in the study. Each principal then collected papers from all the pupils in the fourth grade and made a study of them to determine whether a scale for the four upper grades would also be usable in the fourth grade. The result was a decision

to include the fourth grade. Each principal had now collected approximately 500 papers. Each principal then arranged his papers into 13 piles or qualities ranging from the best to the poorest, and selected two papers from each pile. In addition, each secured two samples of writing from teachers or supervisors which he considered better than any of the pupils' writing collected and two samples of writing from the lower grades which he considered poorer than any of the samples collected. In all each principal furnished 30 samples consisting of two samples of each of 15 qualities, each of the two being different types of writing. This made 240 samples in all. It was the judgment of all the principals co-operating that it would be better to submit to the judges a small number of papers carefully selected, so as to include all qualities and types of writing, than to submit a large number promiscuously selected. The samples submitted to the judges consisted of the first five lines of each paper. These were numbered from 1 to 240. There was no marking whatever on any paper to indicate the identity of the paper.

The judges.—These 240 papers were ranked from 1 to 15 by twenty-five judges consisting of the eight co-operating principals, eight teachers selected because of excellence in teaching writing, eight supervisors, and the Secretary to the Superintendent, an experienced school man. All the judges were directly concerned in the teaching of writing in St. Louis. It is believed that a scale selected as a result of the judgments of those directly concerned in the teaching of writing in our schools would be more likely to be usable as a measuring and a teaching instrument than one otherwise selected. A meeting of the twenty-five judges was held for the purpose of giving instructions. The following set of instructions were given to each judge.

DIRECTIONS FOR GRADING PAPERS

Rank the papers from 1 to 15 by separating the papers into 15 groups. Group 1 should contain the best paper or papers; Group 2, the next best; Group 3, the next, etc.

The difference in degree of quality between Groups 1 and 2 should be approximately the same as between Groups 2 and 3, etc.

Judge each sample of writing by the general impression that you get from looking at the page. The general impression should be determined by a consideration of the following elements:

I. Movement (muscular)
II. Legibility
    a) Form of letters
        1. Size
        2. Slant
        3. Other details
    b) Spacing between letters and words
    c) Relation of letters to line
    d) Uniformity of slant
    e) Color of line

After the separation of the papers into 15 groups is completed, Rank I is to be entered on the tabulation sheet for the papers in Group 1, and Rank II, for papers in Group 2, etc.

Make no notations of any kind whatever on either side of the writing paper.

In order to secure a thoroughly uninfluenced judgment on the part of the individual judges, no one shall give or receive any information whatever about the result of the grouping or about the experience of any other judge in ranking the papers until all of the judges have completed their work.

Table I shows the rank given by each judge upon each paper. For example, paper No. 1 was ranked 6 by judge No. 1; 7 by judge No. 2; 5 by judge No. 3, etc.

TABLE I. (*In Part*)

AGREEMENT AND VARIABILITY SHOWN IN THE TABULATIONS

Showing the rank given by each judge on any paper

Paper No.	Rank Given by Judge No.																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	6	7	5	5	4	6	4	3	3	9	7	8	7	11	13	10	5	5	4	9	5	4	4	8	5
2	6	5	5	4	5	7	6	5	7	10	5	9	5	11	11	10	5	5	8	4	6	4	5	11	7
6	15	13	14	15	15	15	14	14	14	15	14	15	14	15	14	15	15	14	15	14	13	14	14	15	15
10	1	1	1	2	1	1	2	1	1	1	3	2	2	1	1	1	1	1	1	1	4	1	1	1	1
80	1	2	3	7	5	14	3	5	2	10	8	15	6	8	3	13	4	3	8	12	1	6	4	4	6

Table II is a condensation of Table I. It shows that paper No. 1 received 2 judgments for Rank 3, 5 for Rank 4, 6 for Rank 5, etc. The median judgment falls within the number in parentheses. It is evident that there is considerable variability in the judgments for No. 1, which range from Rank 3 to Rank 13. Paper 80 shows the greatest variability of all, ranging in judgments from Rank 1 to

Rank 15. Paper 10 shows the greatest agreement on the part of the judges of all the papers shown. Paper 41 (not shown here) received

TABLE II. (*In Part*)

SHOWING THE NUMBER OF JUDGMENTS GIVEN EACH PAPER FOR EACH RANK

Paper No.	Number Judgments for Rank No.														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.....	....	....	2	5	(6)	2	3	2	2	1	1·	0	1	....	....
2.....	....	....	....	3	9	(3)	3	1	1	2	3	....	....	....	....
6.....	....	....	....	....	....	....	....	....	....	....	....	....	2	(11)	12
10.....	(19)	4	1	1	....	....	....	....	....	....	....	....	....	....	....
80.....	2	2	4	3	(2)	3	1	3	0	1	0	1	1	1	1

TABLE III

SHOWING THE NUMBER OF JUDGMENTS FOR EACH RANK FOR EACH PAPER HAVING A MEDIAN OF 8

Paper No.	Number of Judgments for Rank No.														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
22....	....	....	....	1	2	2	4	7	3	1	2	2	1	....	....
35....	....	....	1	1	1	2	4	7	2	2	2	2	1	....	....
42....	....	....	....	2	3	4	2	3	5	1	1	4	....	....	....
47....	....	....	....	2	3	2	4	4	2	0	3	5	....	....	....
49....	....	....	....	3	0	3	5	8	3	2	4	1	....	....	....
69....	....	....	....	1	2	0	5	6	5	1	2	2	1	....	....
102....	....	....	....	2	2	6	5	5	2	3	3	1	....	....	....
127....	....	....	....	1	0	0	5	8	5	1	3	2	....	....	....
111....	....	....	....	....	1	2	5	5	4	4	2	2	....	....	....
148....	....	....	1	3	0	4	3	3	5	2	0	2	2	....	....
158....	....	....	....	....	2	5	3	4	3	3	1	1	3	....	....
160....	1	....	0	1	0	3	4	5	3	3	3	3	2	....	....
165....	....	....	....	3	1	3	4	3	3	4	1	1	2	....	....
167....	....	....	....	2	0	4	2	8	2	4	2	1	....	....	....
168....	....	....	1	1	1	3	3	5	3	3	1	4	....	....	....
169....	....	....	....	2	1	3	6	4	3	1	2	2	1	....	....
170....	....	....	....	3	3	2	3	8	4	4	1	0	1	....	....
181....	....	....	....	1	4	3	3	4	2	1	1	2	1	3	....
182....	....	....	2	0	1	3	5	6	2	4	0	0	2	....	....
185....	....	....	....	1	2	2	4	7	2	3	1	2	1	....	....
186....	....	....	....	....	1	7	3	5	5	2	1	0	1	....	....
190....	....	1	0	2	2	3	4	5	2	4	2	....	....	....	....
225....	....	....	1	2	2	4	1	5	3	2	1	1	2	....	....
207....	....	....	....	3	1	2	7	6	2	2	1	1	....	....	....
228....	....	....	....	3	1	0	6	4	5	2	1	3	....	....	....
230....	....	....	1	2	3	4	0	3	6	4	1	1	....	....	....

a unanimous vote for Rank 15. This was the only paper ranked the same by all judges. The majority of the papers show a variability

of judgments about like paper 2, ranging over eight ranks. There was much closer agreement on the part of the judges on the papers having a high median rank or a low median rank than on the papers having a median rank from 5 to 10. The variability in judgments is shown in the foregoing tabulation for all papers having a median rank of 8. The judgments on the paper in this group having the *least* variability, Paper 111, extend over 8 ranks.

Selection of the samples for the fifteen-unit scale.—Table IV indicates the measures of central tendency and variability of judgments which were calculated and tabulated. The problem then became that of selecting 15 samples which would be consecutively the same distance apart in value as measured by the exact median and which would have as high a degree of uniformity of judgments as possible. That is, the sample for Rank I must have an exact median as near 1 as possible and must have as high a degree of unanimity of judgments, as indicated by the average deviation and other measures shown in Table IV, as possible. Referring to Table IV we see that there are only four samples from which to select the sample for Rank I. Paper 115 has an exact median nearer to 1.00 than any of the others, the exact median being 1.11. But Sample 79 has one more judgment in the mode and consequently a smaller average deviation. The figures for Sample 10 are the same as for 79. Papers 10 and 79 are considered as being near enough to the ideal median value and as having a higher degree of unanimity of agreement on the part of the judges than any of the other samples in this group. These two papers being tied for Rank I, it was necessary to choose between them either by lot or by rational choice. The latter was followed and Paper 79 was selected. This was the only case of a tie. The paper for each of the other ranks was selected entirely from the figures.

Deciding between a fifteen- and a ten-unit scale.—After the fifteen samples were selected by the application of the principles stated above, a committee of two attempted to arrange them in their correct order from 1 to 15. The experience in this attempt led to the hypothesis that there was not sufficient difference in value between consecutive samples. So a ten-unit scale was selected by selecting papers having a difference of 1.50 between

TABLE IV. (*In Part*)

No. of Paper	Median	Exact Median	No. of Judgments on Median	Mode	No. of Judgments on Mode	Highest Rank	Lowest Rank	Maximum Variation	Maximum Variation on 76 Per Cent Central Cases	Average Deviation from Center
75	1	1.46	13	1	13	1	6	5	2	1.04
79	1	1.16	19	1	19	1	4	3	1	.36
115	1	1.11	18	1	18	1	4	3	1	.40
10	1	1.16	19	1	19	1	4	3	1	.36
227	3	2.69	8	3	8	1	6	5	4	1.12
234	3	3.13	4	......	......	1	8	7	5	1.72
173	3	3.42	6	3	6	1	15	14	6	1.42
191	3	3.40	5	......	......	1	10	9	5	1.84
192	3	3.40	5	2	6	1	9	8	4	.56
197	3	2.92	6	2	9	1	7	6	3	1.20
210	3	2.57	7	2	9	1	7	6	5	1.32
73	3	2.44	9	3	9	1	9	8	5	1.72
81	3	2.88	4	1	6	1	9	8	6	2.00
114	3	2.60	5	2	7	1	10	9	4	1.60
118	3	3.00	9	3	9	1	7	6	4	1.08
120	3	2.57	7	2	11	1	8	7	3	1.16
5	3	3.29	7	3	7	1	14	13	6	2.40
30	3	2.67	9	3	9	1	8	7	2	1.00
38	3	3.11	9	3	9	1	8	7	3	1.12
64	3	2.80	5	2	6	1	7	6	4	1.36
106	7	6.60	5	7	5	3	12	9	5	1.88
112	7	7.25	2	......	......	3	12	9	5	2.00
125	7	6.75	6	7	6	2	1?	10	6	2.00
126	7	7.06	8	7	8	4	13	9	4	1.60
128	7	6.57	7	7	7	3	13	10	5	2.00
139	7	6.67	3	4	5	3	12	9	6	2.16
216	7	6.67	3	4	6	3	12	9	7	2.36
226	7	6.88	4	8	8	2	13	11	4	1.92
231	7	7.33	3	5	5	3	14	11	8	2.80
233	7	7.33	3	5	7	3	13	11	5	2.12
24	7	7.25	10	7	10	3	12	9	4	1.36
36	7	6.80	5	......	......	3	13	10	4	1.52
51	7	7.42	6	7	6	4	12	8	6	2.04
58	7	7.38	4	......	......	3	11	8	6	2.00
60	7	7.00	7	7	7	2	13	11	6	1.92
152	7	6.92	6	7	6	4	14	10	5	1.92
156	7	7.00	3	8	4	2	13	11	6	2.28
177	7	6.88	4	6	6	4	15	11	5	1.96
184	7	6.88	4	8	5	2	13	11	7	2.28
225	15	14.54	13	15	13	12	15	3	2	.84
4	15	14.67	15	15	15	4	15	11	1	.92
41	15	15.00	25	15	25	15	15	0	0	.00
77	15	14.84	19	15	19	12	15	3	1	.32
93	15	14.85	20	15	20	12	15	3	1	.28
101	15	14.53	13	15	13	13	15	2	1	.60
171	15	14.54	13	15	13	7	15	8	2	.92
188	15	14.88	20	15	20	2	15	13	1	.76

consecutive samples instead of 1.00, and having as high degree of agreement in judgments as possible. The following experiment was carried on to determine which scale, the fifteen- or the ten-unit scale, would be most likely to be satisfactory. Nine experienced school men laid out the fifteen-unit scale and the ten-unit scale in the ranking order which each believed to be the correct order, the samples being promiscuously arranged before each attempt. The result is shown in Tables V and VI.

TABLE V

Correct Order	Order in Which the Fifteen Papers Were Ranked by Judge No.								
	1	2	3	4	5	6	7	8	9
1..............	1	2	1	2	1	2	1	2	1
2..............	2	1	2	1	2	3	3	4	3
3..............	3	4	4	4	4	1	2	1	4
4..............	5	3	8	3	3	4	5	3	2
5..............	8	5	5	5	8	5	4	5	5
6..............	4	8	3	8	5	8	8	8	8
7..............	6	7	7	7	7	7	7	7	7
8..............	7	6	6	9	10	10	9	10	6
9..............	9	9	12	6	11	9	6	9	9
10..............	10	10	10	10	9	11	10	11	12
11..............	11	11	9	11	6	6	11	6	11
12..............	12	12	11	12	12	12	12	13	10
13..............	13	13	13	13	13	13	13	14	13
14..............	14	14	14	14	14	14	14	12	14
15..............	15	15	15	15	15	15	15	15	15

TABLE VI

Correct Order	Order in Which the Ten Papers Were Ranked by Judge No.								
	1	2	3	4	5	6	7	8	9
1..............	1	1	1	1	1	1	1	3	1
2..............	3	3	3	3	2	3	3	1	3
3..............	4	2	2	4	3	2	4	2	2
4..............	2	4	5	2	5	7	2	4	4
5..............	5	5	4	5	4	5	5	5	5
6..............	7	7	7	7	7	4	7	6	7
7..............	6	6	6	6	6	6	6	8	6
8..............	8	8	8	8	8	8	8	7	8
9..............	9	9	9	9	9	9	9	9	9
10..............	10	10	10	10	10	10	10	10	10

A study of these two tables shows that there is considerably more deviation from the correct order in the fifteen-unit tabulation

A Tentative Scale for the Measurement of Hand Writing

A new pen has a thin covering of oil to keep it from rusting This oil must be re moved before writing so that the ink will flow freely Pupils should use pen wipers or blotters to wipe the oil off the pen.

MODEL

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing so that the ink will flow freely Pupils should use pen wipers or blotters to wipe the

Sample I.—Slightly irregular in alignment or height of letters Excellent in all other elements.

A new pen has a thin covering of oil to keep it from rusting. This oil must be removed before writing, so that the ink will flow freely Pupils should use a penwiper or blotter

Sample II.—Inferior to I in quality of line, indicating poorer co-ordination; in uniformity of slant; and in letter formation.

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing so the ink will flow freely: Pupils should use penwiper or blotter to wipe the oil from the pen

Sample III.—Inferior to II in quality of line, uniformity of alignment, letter formation, and spacing between the words. The legibility is decreased by the crowding of the words together.

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing. so the ink will flow reely Pupils should use a penwiper or blotter to

Sample IV.—Inferior to III in alignment and letter formation. The loop letters are well formed, but a number of the one space letters are poorly formed.

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing so the ink will flow freely: Pupils should use pen wiper or blotter to wipe the oil from the pen

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing so the ink will flow freely Pupils should use a pen wiper or blotter to

A new pen has a thin covering of oil to keep it from rusting This oil must be removed before writing so the ink will flow free

A new pen has a thin covering, of oil, to keep it from rusting) This oil must be remove before writing, so the ink will flow freely. Pupils

A new pen has a thin covering of oil, to keep it from rusting. This oil must be removed before writing, so the ink will flow freely Pupils should

A new pen has a thin covering of oil, to keep it from rusting

...ore before writing, so the ink will flow freely. Pupils

A new pen has a thin covering of oil, to keep it from rusting. This oil must be removed before writing, so the ink will flow freely. Pupils should

Sample VII.—Inferior to VI in quality of line, letter formation, spacing and uniformity of alignment. In some places the words are too close together and in others the letters are too far apart.

A new pen has a thin covering of oil, to keep it from rusting. This oil must be removed before writing, so the ink will flow freely. Pupils should use a

Sample VIII.—Inferior to VII in spacing, t h e words being so close together as to decrease the legibility. In places the letters are too far apart, and in other places too close together. The degree of slant is too great.

A new pen has a thin covering of oil to keep it from rusting. This oil must be removed before writing. So the ink

Sample IX.—Superior to VIII in quality of line and degree of slant. Inferior in letter formation and uniformity of slant. The size is too great and the spacing too wide, resulting in a serious reduction in the number of words written in the five lines.

A new pen has a thin covering of oil, to keep it from rusting. This oil must be removed before so the ink will flow freely. Pupils should use a pen wiper. should wiper

Sample X.—Markedly inferior to IX in quality of line, uniformity of alignment, and in letter formation.

Analysis of Elements to be Considered in Judging Handwriting.

1. Letter Formation—Primary essential to legibility. The letter formation should be consistent.

2. Uniformity of Slant—Aids. legibility. Result of regularity or control of movement.

3. Uniformity of Alignment—Aids legibility. Result of regularity of movement.

4. Spacing—Between parts of letters, between letters, between words. Aids legibility. Correct spacing results largely from a recognition of correct spacing and a realization of its importance.

5. Quality of Line—Affects legibility to some extent. Good quality of line results from ease, fluency and regularity of movement.

6. Size—Of minor importance unless the size is so extremely small or so extremely large as to affect legibility.

7. Degree of Slant—Medium slant. Extreme slant is due to a wrong position of the paper or to a movement too lateral.

than in the ten-unit tabulation. The experiment seemed to indicate that the difference in value between consecutive samples in the fifteen-unit scale is too small to result in close agreement in the grading of different persons in applying the scale, and that the deviation from the correct order shown in the table for the ten-unit scale is sufficient to insure that ten is not too small a number of units. In other words ten is selected as the number of units on the scale because it is believed that persons in using the scale in grading writing papers will agree more closely than they would with the fifteen-unit scale.

Selection of the samples for the ten-unit scale finally chosen.—The following plan was used in selecting the ten-unit scale. Sample 41 was unanimously ranked 15th, or lowest, by the twenty-five judges (see Table IV). This was selected for the tenth or last unit on the scale. Sample 79 (see Table IV) was selected for first place for the reasons stated previously. The difference between the exact median for the sample for Quality 1 (1.16) and the sample for Quality 10 (15.00) is 13.84. Divide this by the nine spaces that there are between the ten samples and we have an interval of 1.54 between each two consecutive samples. The standard median rank of each of the ten samples and the actual median rank of the samples chosen are shown in Table VII.

TABLE VII

Rank	Standard Median	Actual Median
I....................	1.16	1.16
II....................	2.70	2.67
III....................	4.24	4.22
IV....................	5.78	5.75
V....................	7.32	7.25
VI....................	8.86	8.80
VII....................	10.40	10.20
VIII....................	11.94	11.86
IX....................	13.49	13.40
X....................	15.00	15.00

It would take too much space to go into the details of how each sample was selected from the figures in Table IV, but the samples for Ranks II and V will be given as examples. As just indicated in Table VII, the standard median for Rank II is 2.70. As

shown in Table IV, there are sixteen samples having an exact median between 2.50 and 3.50. The problem is to select a sample with an exact median near 2.70 and with as small a degree of variability in judgments as possible. It is evident that sample 173 would be a poor one because it has an exact median of 3.42 and it has a wide variability in judgments as shown by its large average deviation of 2.42, its wide range in judgments from Rank I to XV, and its small number of judgments on its mode. By consulting the exact medians and the average deviations it is seen at once that the choice will be between Sample 227 and Sample 30. Paper 227 approximates the exact median of 2.70 slightly closer than Paper 30, having a median of 2.69 while the latter has a median of 2.67. But Paper 30 has the advantage of a smaller degree of variability of judgments, as is shown in the following comparison. It has a smaller average deviation, a smaller maximum variation of the central 76 per cent of the judgments, and it has a larger number of judgments on the mode, while Paper 227 has the advantage in only one point, the maximum variation of all judgments. Sample 30 was chosen because it has a median close enough to the ideal median and has a slight advantage in the agreement of judgments.

The sample for Rank V should have a median approximating 7.32 as indicated in Table VII. All samples having a median between 6.50 and 7.50 are assembled together in Table IV. Sample 231 and Sample 233 each has a median of 7.33, but the average deviation in each case is too large to make either of them usable. Paper 24 with an average deviation of 1.36 shows a considerably better agreement of judgments than any other sample in the list. Its median of 7.25 is considered close enough to the standard median.

By this kind of a comparative study from the data on Table IV, each of the samples for the ten ranks were selected.

Making the analysis for the scale.—After the ten samples were selected, a printed copy of each was sent to each of the eight principals, the head writing supervisor, and Professor Freeman of the University of Chicago. Each of these persons prepared an analysis of each sample stating in what respects the sample is

poorer than the one above it and in what respects it is better than the one below it. A committee of two, after a careful study of all the analyses, formulated the analysis as it is printed on the scale. In addition an analysis of the elements entering into the judgment of handwriting is printed at the bottom of the scale. A very important value to the persons co-operating in this study has been the increased ability in the analysis and judgment of handwriting.

PART III. THE SCALE IN USE

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The eight co-operating principals are now using the scale in their schools in accordance with the purposes set forth in Part I of this article. The following are some specific uses being made in one or more schools. In accordance with the suggestions of the supervisor of writing, it is a common practice in St. Louis for each pupil to have a progress package in writing, which consists of samples written from time to time and arranged in such a way that his last paper may be compared with the one before or with the one written at the beginning of the year. The pupil's progress is stated in definite terms when each of the papers is graded by the scale and a numerical rank placed on the paper. By making a tabulation for the class the teacher may see how the class is progressing in terms of definite units.

Table VIII shows the progress of a class from the beginning of school in September until the middle of November, a period of ten weeks. At the beginning of school in September, there were 4 pupils ranked IV, 6 pupils ranked V, 9 pupils ranked VI, etc. In November 1 pupil ranked II, 2 pupils ranked III, 3 pupils ranked IV, 11 pupils ranked V, etc. It is evident that this class has made considerable progress in ten weeks.

Table IX shows the progress of individual pupils for the same class considered in Table VIII. It was a very important thing for the teacher to know that the class had made progress and how much progress the class had made. It is also an important thing

for the teacher and the individual pupil to know how the pupil has progressed.   Table IX (reading from the bottom) shows that 1 pupil advanced 3 ranks, 6 pupils advanced 2 ranks, 9 pupils advanced 1 rank, etc.   It should be borne in mind that an advance

TABLE VIII

SHOWING THE PROGRESS OF A SIXTH-GRADE CLASS

RANK	No. Pupils	
	September	November
I...................	....	....
II...................	....	1
III..................	....	2
IV..................	4	3
V...................	6	11
VI..................	9	13
VII.................	2	5
VIII................	9	1
IX..................	5	....
X...................	1	....

of 1 rank in ten weeks, as measured by this scale of 10 ranks is a big gain.   The 11 pupils who have the same rank at the end of ten weeks as they had at the beginning have not necessarily failed to advance.   They have not advanced to the extent of 1 rank.

TABLE IX

PROGRESS ANALYZED BY INDIVIDUAL PUPILS

Progress Made in Terms of Ranks	Number of Pupils
−2	1
−1	7
0	11
1	9
2	6
3	1

There are 7 pupils who have lost 1 rank and 1 pupil who has lost 2 ranks.   The teacher should be cautioned not to be discouraged about these pupils who have either apparently lost ground or have stood still.   As Professor Swift[1] has pointed out, progress in learning

[1] *Mind in the Making*, chap. vi, "The Psychology of Learning."

is never continuous. Curves drawn to illustrate this show rises and falls and plateaus of arrest. On this particular day these pupils may have fallen far below recent previous attainment. Sudden jumps of progress are often immediately preceded by apparent setbacks. But taken for a sufficiently long period, the line of progress should be upward. For instance, at the end of a year the pupil should show a higher rank than at the beginning of the year. By measuring the pupil's writing every four or five weeks in definite numerical terms with an objective standard and by keeping a record of these measurements, it is possible for the teacher to locate the ones who are not making normal progress, diagnose their cases, discover the causes of the failure to progress, and provide remedies. The pupil takes an interest in keeping this record of progress. Motive for the writing is provided by thus taking advantage of his natural interest in himself as well as his classmates.

Pupils also take an interest in measuring their own writing by the scale. It is a common experience in the schools using the scale that the pupils tend to estimate their writing too high, often very much too high. This seems to indicate that the pupil is satisfied with his writing and that he has not reached the plane of intelligent analysis of his writing. Experiments are being carried out to determine to what extent pupils can be trained to use the scale with a fair degree of skill in grading their own papers and to what extent this will help them to improve their writing.

A very important factor in the successful use of a writing scale is the attainment of skill in the use of it by those concerned in the teaching of writing. Skill in the use of a writing scale will come only as skill in the use of a ruler comes—by a great deal of experience in the use of it. Later in the year experiments will be carried out to determine to what extent different graders will agree in the measurement of the same samples of writing.